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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/138,429 08/24/98 HASHIM I AMAT/2406/MD

IM22/1112

EXAMINER

MERCADO, J.

PATENT COUNSEL
APPLIED MATERIALS INC
PO BOX 450-A
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ART UNIT	PAPER NUMBER
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1753

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DATE MAILED:

11/12/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

File Com

Office Action Summary

Application No.

09/138,429

Applicant(s)

Hashim et al.

Examiner

Julian A Mercado

Group Art Unit

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☐ Responsive to communication(s) filed on _____.

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-20 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-20 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 3

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:
 - a. On page 2 line 29, "through" after "long" requires changing to --throw--.Appropriate correction is required.

Claim Objections

2. Claim 16 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 16 recites a chamber pressure less than 15 mTorr which was already recited in claim 15.

3. Claim 17 is objected to because of the following informalities:
- a. In line 1 of the claim, it is suggested to insert --comprising-- after "further".
- Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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5. Claims 2-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Each of claims 2-5 are dependent on themselves. Although an obvious error, clarification is required in response to this Office Action.

The examiner has interpreted the scope of each of claims 2-5 to be dependent on the previous claim, e.g. claim 2 is dependent on claim 1.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman (U.S. Pat. 5,380,414) in view of either Tepman (U.S. Pat. 5,527,438) or Katsuki (U.S. Pat. 5,728,276)

At the outset, it is noted that the preamble recitation of depositing a magnetic thin film was not given the effect of a limitation in the claim. The preamble appears to be only directed to the purpose or intended use of the apparatus, and the additional components of the claim(s) can stand alone without depending on the preamble for completeness.

In reference to Figure 2, Tepman '414 teaches a sputtering chamber containing a target [2], a substrate [4] having a surface that is separated from the target, and a collimator [3] positioned between the target and the substrate. The target is sputtered at a pressure of less than 15 mTorr. (Col. 2 lines 41-53) Because the collimator is inherently supported by the chamber wall, it is reasonably presumed that the collimator is grounded, or at least would be an obvious configuration to one of ordinary skill in the art. The examiner notes Applicant's disclosure of the instant grounded collimator to be as described in U.S. Patent 5,527,438 to Tepman. (Specification p. 6 lines 3-5) As further evidence of grounded collimators being well-known and conventional, the examiner cites U.S. Patent 5,728,276 to Katsuki *et al* as specifically disclosing collimators to be conventionally kept at ground potential. (Col. 2 lines 31-35)

At the time the invention was made, it would have been obvious to one of ordinary skill in the art that Tepman's '414 invention has a collimator which is grounded, because Tepman's 438 invention or Katsuki specifically teach that collimators are conventionally grounded.

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A magnet array [11] is disposed within the chamber to form a magnetic field at the surface of the substrate. (Col. 5 lines 23-28) Note that the array is disposed at equidistant ends of the substrate, which is a substantially parallel surface. The magnetic field is therefore reasonably presumed to be substantially parallel at the surface of the substrate since the flux lines of the magnetic field are known to conform with the shape of an intervening surface.

9. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman '414 in view of either Tepman '438 or Katsuki as discussed for claim 1 above, and further in view of Hsu (U.S. Pat. 5,589,039).

It is noted that the preamble recitation of depositing a magnetic thin film is now given the effect of a limitation in the claim.

All is applied for Tepman '414 in view of either Tepman '438 or Katsuki as discussed above.

The difference between the claimed invention and Tepman '414 in view of either Tepman '438 or Katsuki not yet discussed is a target that comprises a material that retains magnetic properties when deposited on the surface of the substrate.

Hsu specifically teaches that the domains, i.e. magnetic domains of a sputtered magnetic thin film from a target [21] are aligned during deposition. (Col. 1 lines 43-52)

In addition, Hsu teaches a magnet array [30] disposed within the chamber to form a parallel magnetic field at the substrate surface. (Col. 5 lines 49-53) This teaching of a parallel magnetic field at the substrate surface is considered to be in accordance with a similar

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embodiment in Tepman's '414 invention, or at least would be obvious to one of ordinary skill in the art.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to further modify Tepman's '414 invention by using target that retains magnetic properties when deposited on the surface of the substrate. The motivation for such a modification would be to deposit a corresponding magnetic thin film.

10. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tepman '414 in view of either Tepman '438 or Katsuki and further in view of Hsu as discussed for claims 1 and 2 above, and further in view of Boys *et al* (U.S. Pat. 4,500,409) and Applicant's admitted prior art.

All is applied for Tepman '414 in view of either Tepman '438 or Katsuki and further in view of Hsu as discussed above.

The difference between the claimed invention and Tepman '414 in view of either Tepman '438 or Katsuki and further in view of Hsu not yet discussed is a long throw distance of at least 50 mm, a circular ring magnet array, and a Ni/Fe alloy for the target.

Boys teaches a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37) and the instant Ni/Fe alloy, which is known in the art as Permalloy. (Col. 12 line 23)

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to further modify Tepman's '414 invention by employing a long throw distance of at least 50 mm. A long throw distance of at least 50 mm would have been an obvious modification for

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the skilled artisan in order to enhance the deposition rate and uniformity. It would have also been obvious to use Ni/Fe as the target material as this material is well-known and its use would have been motivated for reasons such as commercial availability and well-known performance for a magnetic film material.

Applicant submits that circular magnet arrays are *well-known* and are therefore considered to be admitted prior art. (Specification p. 1 lines 3-12) The motivation for using circular magnetic array ring would be to form a symmetrical magnetic field around a circular substrate. Note that Hsu teaches a circular target which is *symmetrical* with the substrate. The substrate is therefore reasonably presumed to also comprise a circular shape, or at least would be obvious to one of ordinary skill in the art. (Col. 5 lines 24-27) Figure 5 also illustrates a wafer which is circular in shape.

11. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu in view of Boys *et al.*

All is applied for Hsu and Boys as discussed above.

In addition, Hsu teaches an apparatus for depositing a magnetic film comprising a sputtering chamber [11] containing a target [21] and a substrate. Hsu discloses that a wafer can measure 6x6 inches. (Col. 5 line 18) The intervening space between the target and substrate, in comparison with the wafer diameter shown, therefore appears to be at least 50 mm, or at least as would be obvious to one of ordinary skill in the art. As discussed above, a magnet array [30] is

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disposed within the chamber to form a parallel magnetic field at the substrate surface. (Col. 5 lines 49-53)

In addition to Hsu's stand-alone teaching of the instant long throw distance of at least 50 mm, the examiner relies on Boys to teach a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37)

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to recognize a long throw distance of at least 50 mm as present in Hsu, *or*, modify Hsu's invention accordingly, because such a modification allows for enhanced deposition rate and uniformity.

12. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu in view of Boys *et al* as discussed for claim 6 above, and further in view of Alex (U.S. Pat. 5,616,218) and either Tepman '438 or Katsuki.

All is applied for Hsu in view of Boys *et al*. All is applied for Tepman '438 and Katsuki.

The difference between the claimed invention and Hsu in view of Boys not yet discussed is a grounded collimator between the target and the substrate, and a circular ring magnet array.

Alex teaches a collimator [46] positioned between a target [43] and a substrate [49]. Note that Alex's invention is for the sputtering of a magnetic film. It is considered that this collimator is grounded because the collimator is inherently supported by the chamber wall, which is itself grounded. As discussed above, the examiner also notes Applicant's disclosure of the instant grounded collimator to be as described in U.S. Patent 5,527,438 to Tepman. (Specification

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p. 6 lines 3-5) As further evidence of grounded collimators being well-known and conventional, the examiner cites U.S. Patent 5,728,276 to Katsuki *et al* as specifically disclosing collimators to be *conventionally* kept at ground potential. (Col. 2 lines 31-35) Alex's collimator is therefore considered to be grounded in view of either Tepman '438 or Katsuki, or at least as would be obvious to one of ordinary skill in the art. In addition, it would have been obvious to one of ordinary skill in the art to employ a grounded collimator. The motivation for such a modification would be to control the sputter deposition and crystal structure of the deposited material.

As discussed above, Applicant submits that circular magnet arrays are *well-known* and are therefore considered to be admitted prior art. (Specification p. 1 lines 3-12) The motivation for using circular magnetic array ring would be to form a symmetrical magnetic field around a circular substrate. Note that Hsu teaches a circular target which is *symmetrical* with the substrate. The substrate is therefore reasonably presumed to also comprise a circular shape, or at least would be obvious to one of ordinary skill in the art. (Col. 5 lines 24-27) Figure 5 also illustrates a wafer which is circular in shape.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu in view of Boys *et al*.

All is applied for Hsu and Boys as discussed above.

The difference between the claimed invention and Hsu not yet discussed is the instant chamber pressure less than 15 mTorr or 5 mTorr and a long throw distance of at least 50 mm.

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As discussed above, Boys teaches a chamber pressure of 4 mTorr for the sputtering of a magnetic target. (Col. 12 line 35) Boys teaches a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37)

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify Hsu's invention by employing a chamber pressure less than 15 mTorr. The motivation for such a modification would be to enhance the sputtering or trajectory of the target material, improve deposition uniformity and deposition efficiency, i.e. Angstroms per minute. It would have also been obvious to one of ordinary skill in the art to employ a long throw distance of at least 50 mm. A long throw distance of at least 50 mm would have been an obvious modification for the skilled artisan in order to enhance the deposition rate and uniformity.

14. Claims 10-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu in view of Boys *et al* as discussed for claim 9 above, and further in view of Alex, Applicant's admitted prior art, and either Tepman '438 or Katsuki.

Hsu further teaches that the target is sputtered by a plasma generated in a magnetic field maintained adjacent the target by a magnetron [23] disposed outside the sputtering chamber. (Figure 1, col. 5 lines 31-40)

As discussed above, Applicant submits that circular magnet arrays are *well-known* and are therefore considered to be admitted prior art. (Specification p. 1 lines 3-12) The motivation for using circular magnetic array ring would be to form a symmetrical magnetic field around a circular substrate. Note that Hsu teaches a circular target which is *symmetrical* with the substrate. The

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substrate is therefore reasonably presumed to also comprise a circular shape, or at least would be obvious to one of ordinary skill in the art. (Col. 5 lines 24-27) Figure 5 also illustrates a wafer which is circular in shape.

As discussed above, Boys teaches a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37) Boys further teaches the instant Ni/Fe alloy, which is known in the art as Permalloy. (Col. 12 line 23)

The difference between the claimed invention and Hsu in view of Boys not yet discussed is the instant collimating sputtering of the target with a grounded collimator disposed between the target and the substrate.

As discussed above, Alex teaches a collimator [46] positioned between a target [43] and a substrate [49]. Note that Alex's invention is for the sputtering of a magnetic film. It is considered that this collimator is grounded because the collimator is inherently supported by the chamber wall, which is itself grounded. As discussed above, the examiner also notes Applicant's disclosure of the instant grounded collimator to be as described in U.S. Patent 5,527,438 to Tepman. (Specification p. 6 lines 3-5) As further evidence of grounded collimators being well-known and conventional, the examiner cites U.S. Patent 5,728,276 to Katsuki *et al* as specifically disclosing collimators to be *conventionally* kept at ground potential. (Col. 2 lines 31-35) Alex's collimator is therefore considered to be grounded in view of either Tepman '438 or Katsuki, or at least as would be obvious to one of ordinary skill in the art.

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15. Claim 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alex in view of Boys *et al*, Hsu, Applicant's admitted prior art, and either Tepman '438 or Katsuki.

All is applied for Alex, Tepman '438 and Katsuki as discussed above. As discussed above, Alex's collimator is considered to be grounded in view of either Tepman '438 or Katsuki. Alex also specifically teaches the collimator to intercept some of the sputtered target particles. (Col. 6 lines 63-65) Charged particles from the target are therefore reasonably presumed to be intercepted by the collimator. The examiner notes Applicant's disclosure that *grounding of the collimator*, which Alex is submitted to employ, eliminates interference with a magnetic field. (Specification, p. 6 lines 12-14)

The difference between the claimed invention and Alex in view of either Tepman '438 or Katsuki not yet discussed is sputtering the target onto the surface of the substrate at a pressure of less than 15 mTorr and providing a parallel magnetic field at the surface of the substrate during sputtering.

All is applied for Boys as discussed above, wherein Boys was cited to teach a chamber pressure of 4 mTorr for the sputtering of a magnetic target. (Col. 12 line 35) In addition, Boys teaches a long throw distance equal to 2.5 in or 63 mm. (Col. 12 line 37) Boys further teaches the instant Ni/Fe alloy which is known in the art as Permalloy. (Col. 12 line 23)

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify Alex's invention by employing a pressure of less than 15 mTorr, e.g. 4 mTorr for the chamber pressure. The motivation for such a modification would be to enhance the

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sputtering efficiency and uniformity, as taught by Boys. A long throw distance of at least 50 mm would have also been an obvious modification for the skilled artisan in order to enhance the deposition rate and uniformity. The use of Permalloy would have been obvious to the skilled artisan for reasons such as commercial availability and well-known performance for a magnetic film material.

All is applied for Hsu as discussed above, wherein a magnet array [30] is disposed within the chamber to form a parallel magnetic field at the substrate surface. (Col. 5 lines 49-53 and col. 8 lines 24-26) As discussed above, Applicant submits that circular magnet arrays are well-known and is therefore considered to be admitted prior art. (Specification p. 1 lines 3-12) The motivation for using circular magnetic array ring would be to form a symmetrical magnetic field around a circular substrate. Hsu teaches a circular target which is *symmetrical* with the substrate, the latter therefore reasonably presumed to also comprise a circular shape, or at least would be obvious to one of ordinary skill in the art. (Col. 5 lines 24-27) Figure 5 also illustrates a wafer which is circular in shape.

At the time the invention was made, it would have also been obvious to one of ordinary skill in the art to provide a parallel magnetic field at the surface of the substrate during sputtering. The motivation for such a modification would be to align the magnetic domains of the sputtered film.

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Conclusion


16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 4,776,938 to Abe *et al*, U.S. Patent 5,593,551 to Lai are cited of general interest.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julian A. Mercado whose telephone number is (703) 305-0511 . The examiner can normally be reached on Monday through Thursday from 8:30 AM to 6:00 PM. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen, can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7718.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


NAM NGUYEN
PRIMARY EXAMINER
GROUP 1109


January/November 8, 1999